Reply Comments of

The Ultra Wide Band (UWB) Alliance

Before

The Federal Communications Commission

Notice of Inquiry on Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz.

ET Docket No. 18–295
GN Docket No. 17-183
FCC 18–147

March 18, 2019

Executive Summary

Wi-Fi broadband is an essential part of the wireless networking fabric that empowers the new age of local area wireless communication. The Ultra Wide Band (UWB) Alliance endorses rules changes that enable and encourage innovation which expands the usefulness and value of spectrum for all users.

However, the broadband proponents have not correctly represented the current and rapidly growing value of the UWB and Part 15.250 market that is operating in the 6 GHz band. There are multiple millions of devices in use daily in many applications, not just a few industrial facilities. These products are in use in every NFL stadium,[1] they are designed into consumer vehicles for secure access and operation applications,[2] used in bus deployment applications in major cities such as Minneapolis,[3] used daily throughout multiple aircraft assembly plants,[4] and used across a final assembly and flight test line of another aircraft manufacturer for a critical USAF program.[5] Additionally, there is an enhancement for the current IEEE 802.15.4 UWB standard that is attended by groups of engineers that are affiliated with the largest smartphone manufacturers in the world.[6]

We offer alternatives which could expand the utilization of the unlicensed spectrum for all users including broadband without impacting incumbent users:

- Adding 5.925-6.1 GHz of bandwidth with an OOBE of -61 dBm requirement; or
- Adding operation throughout the band with 0.5% duty cycle and PSD of -21.3dBm/MHz; peak power at 0dBm; and
- AFC everywhere.

Crisis of Choice

The term 'spectrum crisis' has been used to add an emotional element to that which is a very straightforward rule change evaluation. The 'crisis' is a crisis of choice that has been marketed to maximize the profitability for a single technology that is an evolution of technology from the 1990s. It is an attempt to pseudo-license an unlicensed portion of the radio spectrum by filling the spectrum with overwhelming transmission power levels and then demanding that the entire 1.2 GHz be theirs and theirs alone. By bringing forward the old U-NII technology, the entities driving this perception of a

---

[1] *See* Comments of Zebra Technologies, Inc. at 1, GN Docket No. 17-183, filed February 15, 2019.
[2] *See* Comments of Marquardt GmbH, GN Docket No. 17-183, filed March 15, 2019.
[3] *Twin Cities' Bus Garages Increase Visibility – Minneapolis-St. Paul's Metro Transit uses a Ubisense RFID system to help it locate 900-plus buses at its five parking garages*, RFID Journal, November 3, 2009.
[4] *See* Zebra, at 1.
[5] *See* Comments of The Boeing Company at 4, GN Docket No. 17-183, filed February 15, 2019.
[6] *See* IEEE 802.15 TG4z Working Group.

crisis desire to make minimal changes to the current technology without incurring the cost of innovating and developing more spectral-efficient alternatives.

An examination of WLAN use in a typical urban environment illustrates that the limitations that appear to be impeding WLAN growth are largely due to WLAN interfering with WLAN. In a typical urban setting you find many independently operated, unmanaged and uncoordinated WLANs overlapping and causing mutual interference. Each Access Point (AP) and Station (STA) operates at maximum permissible power without consideration of the power (and thus interference footprint) necessary to achieve the required margin. Link margin in excess of what is needed does nothing to improve performance, but rather increases self-interference and decrease performance of all surrounding devices. As was noted in several comments, many applications of WLAN do not require more than a few meters of radio range. However, typical implementations are optimized to maximize radio range, and they themselves are causing saturation of the spectrum (i.e., the aforementioned 'crisis').

There are in fact many innovative techniques that have been developed (e.g., advanced features included in IEEE Standard 802.11 that enable more efficient use of the spectrum by reducing interference and enhancing coexistence of overlapping WLANs and other technologies) which have not been adopted by major WLAN advocates and vendors. They are instead asking the Commission to solve their stagnation by allocating more spectrum, without themselves using the tools at their disposal to address the problem they themselves have created.

Congress has mandated that 100 MHz unlicensed, plus 55 MHz of licensed or unlicensed spectrum be designated to high-speed broadband. This is a reasonable and significant addition to the approximately 665 MHz of spectrum within the 2.4 and 5.8 GHz bands currently available for use by the Wi-Fi industry. Additionally, while the 6 GHz expansion of unlicensed utilization is being promulgated, there is another NPRM that is in motion to free an additional 500 MHz the 3.7 – 4.2 GHz band. Therefore, the Congressional mandate is already in route to being fulfilled using current technology in excess of its requirements by over 345 MHz.

In addition, there are already rules which provide access to 1.2 GHz of license-exempt spectrum at 6 GHz as well as 7.5 GHz of spectrum between 3.1 and 10.6 GHz available for those willing to innovate and comply with the existing Part 15 rules. Many of the applications sited in support of the need for additional license exempt spectrum can be met under existing rules. For those willing to take advantage of spectrum available at 60 GHz there is adequate bandwidth to enable innovative applications such as VR with no rule change required.

In the comments from the UWB Alliance,[7] we suggested an expansion that would provide yet another additional 175 MHz of bandwidth in the 5.925 – 6.1 GHz band yielding a total gain of 675 MHz and

[7] *See* Comments of the Ultra Wide Band Alliance, GN Docket No. 17-183, filed February 15, 2019.

provide unimpeded coexistence to incumbent unlicensed users and most licensed FS and FSS users if a -61 dBm OOBE mask was adopted for the broadband technology. This approach would enable new uses of legacy WLAN technologies, continue the opportunity for existing Part 15 systems, as well as provide an opportunity for innovative use of the remaining 6 GHz band in a manner compatible with existing users.

New comments from the broadband community are now requesting power be allowed to be transmitted at (25 mW) for all U-NII devices across the entire 1.2 GHz starting a 6 GHz both indoor and out use with no mitigation requirements at all.[8] This would not only render devices operating under Part 15.250 and Subpart F as undependable and therefore impact many applications, but would also significantly impact licensed fixed service (FS) and fixed satellite services (FSS), as well as scientific and radio astronomy applications. Note, as a reminder, that these services are used for connectivity in rural areas, safety applications for first responders, and communications used for mobile television media video/audio links throughout the USA.

UWB and Part 15.250 Wideband devices are utilized as unlicensed participants of the shared band between 6 and 7.125 GHz. As such these users of this spectrum receive no protection and must be able to accept interference from other users. However, never before has such a mismatch of power levels been proposed between two user groups that are expected to share spectrum within the same band. The ratio of PSD power of 25 Mw signals across a 20 MHz channel bandwidth compared to current Part 15.250 rules is 16,666:1. If it were spread over the requested maximum of 320 MHz channel bandwidth the difference would still be 1042:1 (30 dB). The Commission has promulgated rules intended to drive innovation, and the industry has responded with innovative use of the spectrum that has been proven to protect licensed users as well as promote good coexistence of license-exempt users. It is reasonable and appropriate for the Commission to consider the impact on those who have practical and valuable users in the band, and to ensure the new rules do not undo the good achieved by the Commission in the past.

Wi-Fi proponents have talked about the requirement for bandwidth, but not explained the requirement for so much power. The UWB Alliance questions the requirement for all this power. We suggest an incremental approach to what is effectively increasing the 15.250 power limits across the entire 6 GHz band. An increase to -21.3 dBm/MHz seems a more rational increment.

---

[8] *See* Comments of Apple Inc., Broadcom Inc., Cisco Systems, Inc., Facebook, Inc., Google LLC, Hewlett Packard Enterprise, Intel Corporation, Marvell Semiconductor, Inc., Microsoft Corporation, Qualcomm Incorporated, and Ruckus Networks, an Arris Company, GN Docket No. 17-183, filed February 15, 2019; *Also See* Comments of Broadcom Inc. at 6 and 27-29, GN Docket No. 17-183, filed February 15, 2019; *Also See* Comments of Hewlett Packard Enterprise Company at 7, 16, 31, GN Docket No. 17-183, filed February 15, 2019; *Also See* Comments of Broadcom Inc. at 6 and 27-29, GN Docket No. 17-183, filed February 15, 2019; *Also See* Comments of Facebook, Inc. at 2, 3, 5, GN Docket No 17-183, filed February 15, 2019; *Also See* Comments of Apple, Inc., at 2, 3, 7, 9, GN Docket No 17-183, filed February 15, 2019.

The crisis of choices that leads to WLAN "running out of spectrum" will not be solved by simply adding more spectrum. Eventually that too will become saturated with WLAN devices creating self-interference while also impeding progress in new technologies. A better solution would be to utilize methods and mechanisms available to the WLAN community and to innovate to improve their systems.

Comment to Comments On "Very Low Power"

Several commenters suggest allowing license-exempt operation in vehicles.[9] These comments recommend very-low-power device class that can operate indoors or outdoors across either the entire band[10,11] or a in U-NII-5 U-NII-7 and the bottom 100 megahertz of U-NII-8[12,13]. They site applications such as augmented and virtual reality (AR/VR), wearable peripherals, and WLANs inside personal vehicles where WLAN devices are typically within 1m of the AP and so the range of the WLAN devices is typically less than 1m. In such scenarios the required WLAN range can be achieved using far lower power (e.g. the -21.3 dBm/MHz suggested by NXP).[14] We further note that such limits would be beneficial to the WLAN users, as those uses sited would tend to have many independent WLANs in close proximity and reduce interference footprint improves WLAN performance. We support the Commission's move to enable expanded use and innovation in the band, but feel a more reasonable incremental approach to increasing allowable power is needed. 14dBm EIRP is far in excess of what is necessary and the need for such a dramatic increase in power is not explained.

The UWB Alliance strongly agrees that for applications such as in-vehicle WLAN where all participating devices are close proximity, far lower power is required than where large LAN coverage is needed. We endorse the concept that at sufficiently low power, combined with duty cycle constraints, license-exempt devices may safely operate without causing harmful interference. We further agree with other commenters (e.g., NXP) that allowing such operation be conditional on specific power constraints and duty cycles as used in their RKF studies. The UWB Alliance has determined through Monte Carlo analysis that if U-NII operation is constrained to 0.5% duty cycle coexistence is greatly improved.

Using established methods for calculating the required power (i.e., the NIST Link budget calculator with large city/urban propagation model), with parameters typical of WLAN implementations (i.e. IEEE Standard 802.11), it is seen that EIRP of much less than 0dBm is sufficient for closing a link at 5m to 10m range, and less than -20 dBm is sufficient to achieve positive link margin at 1 to 3m as would be

---

[9] Ibid.
[10] *See* Comments of Facebook, Inc., GN Docket No 17-183, filed February 15, 2019.
[11] *See* Comments of Apple, Inc., at 2, 3, 7, 9, GN Docket No 17-183, filed February 15, 2019.
[12] *See* Comments of Apple Inc., Broadcom Inc., Cisco Systems, Inc., Facebook, Inc., Google LLC, Hewlett Packard Enterprise, Intel Corporation, Marvell Semiconductor, Inc., Microsoft Corporation, Qualcomm Incorporated, and Ruckus Networks, an Arris Company, GN Docket No. 17-183, filed February 15, 2019.
[13] *See* Comments of Broadcom Inc. at 6 and 27-29, GN Docket No. 17-183, filed February 15, 2019.
[14] *See* Comments of NXP USA, Inc., GN Docket No. 17-183, filed February 15, 2019.

more typical inside a vehicle. Experience in the UWB industry shows that there are technologies that can achieve WLAN target data rates and functionality within a network range of a few meters operating at the -41.3 dBm/MHz limit as allowed currently by Part 15 (subpart C and F). Considering what has been shown as practical and considering the limitations of current WLAN implementations as well with analysis of the proposed scenario, we urge the Commission to consider establishing power limits of no more than a PSD of -21.3dBm/MHz as suggested by NXP,[15] with peak power at 0dBm. This limit is sufficient to allow evolutionary adoption of conventional WLAN technologies (e.g. 802.11 based) to operate inside vehicles and in other very small LAN scenarios, and a more modest incremental increase over the proven limits of existing rules, e.g. 15.250. This would also reduce dramatically the interference caused by overlapping WLANs as is likely to occur with in-vehicle use in an urban setting. This would provide much higher confidence that harmful interference risk is contained. We further note that this safe yet practical limit would enhance performance of ALL systems using the spectrum, including multiple overlapping WLANs, and enables an important use case for license-exempt devices inside and very near to vehicles.

AFC

The UWB Alliance agrees with the Dynamic Spectrum Alliance (DSA) comments that AFC can be an effective approach for protecting other spectrum users and for coordination of spectrum usage to maximize value.[16] We agree that AFC can and should be developed to be realistically implemented in license exempt devices. We also agree that AFC can and should be applied to all sub-bands. As presented by the DSA, the Commission should establish precise requirements for AFC assure protection and enable coordination, with clear incentives to industry to develop effective AFC system, and not overly prescribe the technical approach.[17]

In our previous comments the UWB Alliance has suggested AFC be applied to all of the proposed sub-bands. The DSA comments support this proposal. If DSA suggestions on AFC are applied, the UWB Alliance feels that this would enable the development of an AFC system that can practically and cost-effectively be applied to the entire band. We further suggest the Commission consider applying AFC as a means to provide coordination and coexistence between license-exempt systems operating at power levels above those currently prescribed for wide-band (and UWB) systems in the band. This would further maximize the value of the spectrum by enabling more diverse uses.

---

[15] Ibid. NXP at 3.
[16] *See* Comments of the Dynamic Spectrum Alliance at 3, GN Docket No. 17-183, filed February 15, 2019.
[17] Ibid. Dynamic Spectrum Alliance at 10.

Technology Agnostic

Ex Parte comments filed by Qualcomm[18] suggest that the Commission incorporate rules requirements into the NPRM for a specific technology. The UWB Alliance reiterates our position that rules for license-exempt operation should be technology neutral. History shows that by formulating rules in a technology-agnostic manner enables innovative solutions. The UWB alliance strongly endorses technology-agnostic rules that do not favor a particular technology, e.g. 5G NR-U or WLAN, but continue to promote a level field in which innovation can prevail.

The Qualcomm comments do underscore the complexities of license-exempt use. The model of use in a dedicated band where all devices are operating under control of a single service provider for which mobile service protocols have been optimized is fundamentally different than the license-exempt situation where it can be assured only that there will be devices using different protocols without coordination. The fundamental assumptions are profoundly different. The Commission has previously acknowledged that coordination schemes to dominate a license-exempt band are inappropriate (e.g. 15.247).

We urge the Commission to remember that favoring a particular technology in a license-exempt rule is counter to the goal of promoting new, innovative uses of spectrum. We urge the Commission to temper the cries for ever more WLAN spectrum with consideration of the benefits to all, including the WLAN community, in moving forward versus just doing the same thing in a different band.

[18] *See Ex Parte* Filing by Qualcomm Inc., GN Docket No. 17-183, filed March 8, 2019.